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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/887,199	06/21/2001	Ivo Raaijmakers	ASMMC.005AUS	7254

7590

11/05/2002

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EXAMINER

MAI, ANH D

ART UNIT

PAPER NUMBER

2814

DATE MAILED: 11/05/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/887,199

Applicant(s)

RAAIJMAKERS ET AL.

Examiner

Anh D. Mai

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 August 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-58 is/are pending in the application.
- 4a) Of the above claim(s) 2-5 and 20-58 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1 and 6-19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 June 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of the invention Group I, claims 1-42 in Paper No. 6 is acknowledged. Applicant is further elected with traverse of species Groups Ib, claims 6-10. The traversal is on the ground(s) that claim 20 is generic to all of claims 6-19. This is not found persuasive because there is no relationship between claim 20 and claims 6-19.

The requirement is still deemed proper and is therefore made FINAL.

Note that claim 1 is generic to the two species claimed in Group Ia and Ib only.

2. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or

(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

3. Claims 1 and 6 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Sherman (U.S. Pub No. 2002/0031618).

Sherman teaches a method of fabricating trench isolation structures between integrated electrical device in a semiconductor substrate as claimed including:

placing a semiconductor substrate in a reaction chamber, the semiconductor substrate comprises trenches; and

filling the trenches with insulating material by atomic layer deposition, comprising a plurality of primary cycle, each primary cycle comprising, in sequence:

introducing a first vapor-phase reactant to the substrate, thereby forming no more than about one monolayer of a first reactant species conforming at least to surface of the trenches;

removing excess first vapor-phase reactant and byproduct from the reaction chamber;

introducing a second vapor-phase reactant to the substrate, thereby reacting with the first reactant species conforming at least to the surfaces of the trenches; and

removing excess second vapor-phase reactant and by product from the reaction chamber.

(See pages. 1-9).

With respect to claim 6, the filling method of Sherman further includes a plurality of secondary cycles, each secondary cycles comprising, in sequence:

Introducing a third vapor-phase reactant to the substrate, thereby forming no more than about one monolayer of a third reactant species conforming at least to surfaces of the trenches, the third reactant species being different from tile first reactant species;

removing excess third vapor-phase reactant and byproduct from the reaction chamber,
introducing a fourth vapor-phase reactant to the substrate, thereby reacting the third
reactant species conforming at least to the surface of the trenches; and
removing excess fourth vapor-phase reactant and byproduct from the reaction chamber.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all
obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 7-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sherman as applied to claim 6 above, and further in view of Gates et al. (U.S. Patent No. 6,203,613).

With respect to claim 7, Sherman teaches filling the trenches using plurality of primary and secondary cycles including the first vapor-phase reactant comprises a first reactant source gas, the third vapor-phase reactant comprises a first reactant source gas and the second and fourth vapor-phase reactant comprises oxidant source gas.

Thus, Sherman is shown to teach all the features of the claim with the exception of explicitly using silicon and aluminum source gases for the first and third vapor-phase reactant, respectively.

However, Gates teaches: the any combination of multiplayer metal oxide can be used including silicon and aluminum. (See col. 5, lines 55-65 and col. 8, lines 50-53).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the multiplayer insulating of Sherman using the first and third vapor-phase reactants comprise silicon and aluminum, respectively as taught by Gates because the films formed have superior electrical properties.

With respect to claim 8, the aluminum source gas of Gates also includes alkyl aluminum compounds and the oxidant source gas includes water.

With respect to claim 9, the filling of the trench of Sherman in view of Gates consists of mixing the primary cycle and secondary cycles and the mixing ratio appears to be within the claimed ratio between about 20:1 and 1:10.

With respect to claim 10, the deposition method of Gates includes: a primary cycle deposit a first oxide species and a secondary cycle deposit a second oxide species.

With respect to claim 11, the first oxide species of Gates is silicon oxide and the second oxide species is a metal oxide. (See Example 4).

With respect to claim 12, the second oxide species of Gates also includes aluminum oxide. (See col. 5, lines 55-65).

With respect to claims 13 and 14, the method of Gates includes any combination of multiplayer metal oxide film.

Since ALD process can form monolayer-by-monolayer, therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the multiplayer metal oxide in any combination, since it has been held to be within the general skill of a worker

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in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

Further, within purview of one having ordinary skill in the art, it would have been obvious to determine the optimum weight ratio of aluminum oxide in silicon oxide insulating material. See In re Aller, Lacey and Hall (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation".

With respect to claim 15, at least a portion of the first and second oxide species of Gates combine to form a separate phase appears to be in equilibrium with a portion of the first oxide.

With respect to claim 16, since silicon oxide and aluminum oxide are contemplated by Gates, thus, the separate phase of Gates also comprises mullite.

With respect to claim 17, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

With respect to claims 18 and 19, since the insulating oxide species are used to fill the trench of Sherman, one having ordinary skill in the art should have recognized that CTE of the filler materials should match that of the semiconductor substrate to prevent unnecessary stress on the semiconductor substrate which is a main cause of failure.

Further, within purview of one having ordinary skill in the art, it would have been obvious to determine the optimum matching percentage of CTE (e.g. within 10 % or 20 %). See In re Aller, Lacey and Hall (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation".

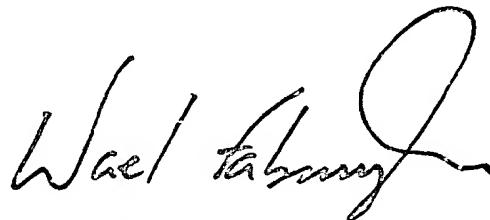
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A.M
October 31, 2002



SUPERVISORY PRIMARY EXAMINER
TECHNOLOGY CENTER 2800